CLAIMS

1. A method for megasonic cleaning a substrate, comprising the steps of:

a) providing a container;

b) providing a first megasonic transducer with a first active surface in said container;

c) disposing a substrate in said container substantially parallel to and spaced from said first transducer;

d) flowing a fluid through said space between the substrate and said first transducer;

e) immersing the wafer with said fluid in said container; and

f) applying energy to said first megasonic transducer.

2. A method as recited in claim 1, further comprising the step of providing relative motion between said individual substrate and said transducer in a direction substantially parallel to the substrate, while performing said fluid-flowing and energy-applying steps (d) and (f).

3. A method as recited in claim 1, wherein said individual substrate has a substrate surface area and said first active surface has an area at least equal to 40% of the substrate surface area.

4. A method as recited in claim 1, wherein the substrate has a maximum diameter and said space is in a range from 1% to 80% of said maximum diameter.

5. A method as recited in claim 1, wherein said space is in a range from 1 micrometer to 160 millimeters.

6. A method as recited in claim 1, wherein said megasonic energy applied to said megasonic transducer has a frequency of at least 400 kilohertz.

7. A method as recited in claim 1, wherein said megasonic energy applied to said megasonic transducer has a maximum power of at least 400 watts.

8. A method as recited in claim 7, wherein said megasonic energy is applied to said megasonic transducer with 20% to 100% of said maximum power.

9. A method as recited in claim 1, wherein said transducer has an area and a total input power and wherein said input power divided by said transducer area is at least four watts per square centimeter.

10. A method as recited in claim 1, wherein said flowing a fluid step (d) comprises flowing a fluid through said space between the substrate and said transducer at a fluid flow rate sufficient to carry particles away from the substrate before they redeposit on the substrate.

11. A method as recited in claim 1, wherein said container has a volume and wherein said flowing a fluid step (d) comprises flowing a fluid through said space between the substrate and said transducer at a rate to replace the fluid in said volume in less than

or equal to one minute.

12. The method as recited in claim 1, further comprising the step of providing a second megasonic transducer with a second active surface in said tank, wherein said second active surface faces said first active surface, and is substantially parallel to and spaced from said first active surface.

13. The method as recited in claim 12, wherein in said providing step (b) said first transducer and said second transducer are both completely immersed in said fluid.

14. The method as recited in claim 12, wherein said disposing step (c) comprises disposing the substrate in the tank between said first active surface and said second active surface.

15. The method as recited in claim 14, wherein said flowing step (d) further comprises flowing the fluid through space between the substrate and the second active surface.

16. The method as recited in claim 15, wherein said applying energy step (f) further comprises applying energy to said second megasonic transducer.

17. The method as recited in claim 12, wherein said megasonic transducers provide energy to clean both sides and edges of the substrate.

18. The method as recited in claim 1, wherein said fluid comprises one of deonized water, dilute RCA cleaning solution and dilute citric acid solution.

19. The method as recited in claim 1, wherein in said providing step (b) said active surface is arranged in a horizontal plane.

20. The method as recited in claim 1, wherein in said providing step (b) said active surface is arranged in a vertical plane.

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21. The method as recited in claim 1, wherein in said flowing step (d) fluid is provided in said tank at a lower level than it exits said tank

22. The method as recited in claim 1, wherein in said providing step (b) said first transducer is completely immersed in said fluid.

23. A method for megasonic cleaning a substrate, comprising the steps of:

a) providing a container comprising a first megasonic transducer with a first active surface, wherein said first magasonic transducer is held in a fixed position in said container;

b) disposing a substrate in said container substantially parallel to and spaced from said first active surface;

c) flowing a fluid through said space between the substrate and said first active surface; and

d) applying energy to said first megasonic transducer.

24. A method for megasonic cleaning a substrate, comprising the steps of:

a) providing a first megasonic transducer with a first active surface;

b) providing a second megasonic transducer with a second active surface facing said first active surface and parallel thereto;

c) disposing a substrate between said first surface and said second surface to provide a first space between the substrate and said first surface and a second space between the substrate and said second surface;

d) flowing a fluid through said first space and through said second space; and

e) applying energy to said first megasonic transducer and to said second megasonic transducer to clean two sides of the substrate.

25. A method as recited in claim 24, further comprising the step of providing relative motion between said individual substrate and said transducer in a direction substantially parallel to the substrate, while performing said fluid-flowing and energy-applying steps (d) and (f).

26. A method as recited in claim 24, wherein the substrate has a maximum diameter and said space is in a range from 1% to 80% of said maximum diameter.

27. A method as recited in claim 24, wherein said space is in a range from 1 micrometer to 160 millimeters.

28. A method as recited in claim 24, wherein said megasonic energy applied to said

megasonic transducer has a frequency of at least 400 kilohertz.

29. A method as recited in claim 24, wherein said megasonic energy applied to said megasonic transducer has a maximum power of at least 400 watts.

30. A method as recited in claim 29, wherein said megasonic energy is applied to said megasonic transducer with 20% to 100% of said maximum power.

31. A method as recited in claim 24, wherein said transducer has an area and a total input power and wherein said input power divided by said transducer area is at least four watts per square centimeter.

32. A method as recited in claim 24, wherein said flowing a fluid step (d) comprises flowing a fluid through said first space and through said second space at a fluid flow rate sufficient to carry particles away from the substrate before they redeposit on the substrate.

33. A method as recited in claim 24, wherein said container has a volume and wherein said flowing a fluid step (d) comprises flowing a fluid through said spaces at a rate to replace the fluid in said volume in less than or equal to one minute.

34. The method as recited in claim 24, wherein in said providing step (b) said first transducer and said second transducer are both completely immersed in said fluid.

35. The method as recited in claim 24, wherein in said disposing step (c) said substrate is completely immersed in said fluid.

36. The method as recited in claim 24, wherein said megasonic transducers provide energy to clean edges of the substrate.

37. The method as recited in claim 24, wherein said fluid comprises one of deonized water, dilute RCA cleaning solution and dilute citric acid solution.

38. The method as recited in claim 24, wherein in said providing step (b) said active surface is arranged in a horizontal plane.

39. The method as recited in claim 24, wherein in said providing step (b) said active surface is arranged in a vertical plane.

40. The method as recited in claim 24, wherein in said flowing step (d) fluid is provided in said tank at a lower level than it exits said tank

41. An apparatus for megasonic cleaning a substrate, comprising:

a container for immersing a substrate in a fluid;

a first megasonic transducer with a first active surface in the fluid in said container for providing energy to clean the immersed substrate placed substantially parallel to and spaced from said first active surface.

42. An apparatus as recited in claim 41, further comprising means for providing relative motion between the substrate and said transducer in a direction substantially parallel to the substrate surface while flowing said fluid and applying said megasonic energy.

43. An apparatus as recited in claim 41, wherein the substrate has a major surface area and the substrate is disposed so that said transducer faces at least 40% of said major substrate surface area.

44. An apparatus as recited in claim 41, wherein said substrate has a maximum diameter and said space is in a range from 1% to 80% of said maximum diameter.

45. An apparatus as recited in claim 41, wherein said space is in a range from 1 micrometer to 160 millimeters.

46. An apparatus as recited in claim 41, wherein said megasonic energy applied to said megasonic transducer has a maximum power of at least 400 watts.

47. An apparatus as recited in claim 28, wherein said megasonic energy is applied to said megasonic transducer with 20% to 100% of said maximum power.

48. An apparatus as recited in claim 41, wherein said transducer has a transducer area and a total input power and wherein said input power divided by said transducer area is at least four watts per square centimeter.

49. The apparatus as recited in claim 41, further comprising a second megasonic transducer with a second active surface in said tank, wherein said second active surface faces said first active surface and is substantially parallel to and spaced from said first active surface for cleaning both sides of a substrate and edges of a substrate placed between said first active surface and said second active surface.

50. The apparatus as recited in claim 49, wherein said first transducer and said second transducer are disposed vertically.

51. The apparatus as recited in claim 49, wherein said first transducer comprises an array of transducers.

52. The apparatus as recited in claim 51, wherein said array of transducers are disposed horizontally and wherein openings between transducers permit fluid to flow there through.

53. The apparatus as recited in claim 49, wherein said first transducer is in a fixed position and said second transducer is moveable.

54. The apparatus as recited in claim 49, wherein said first transducer and said second transducer are both completely immersed in said fluid.

55. The apparatus as recited in claim 41, wherein said fluid comprises one of deonized water, dilute RCA cleaning solution and dilute citric acid solution.

56. The apparatus as recited in claim 41, wherein said first active surface is arranged in a horizontal plane.

57. The apparatus as recited in claim 41, wherein said first active surface is arranged in a vertical plane.

58. The apparatus as recited in claim 41, wherein said first transducer is completely immersed in said fluid.